THE INFLUENCE OF UPPERMOST AXILLARY SHOOTS AND PLANT GROWTH SUBSTANCES ON THE DEVELOPMENT OF THE LOWER AXILLARY SHOOTS OF DENT CORN

BY

JEROME CLEMENT LYONS

B.S., University of Illinois, 1947
M.S., University of Illinois, 1948

AN ABSTRACT OF A THESIS

SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
FOR THE DEGREE OF DOCTOR OF PHILOSOPHY IN AGRONOMY
IN THE GRADUATE COLLEGE OF THE
UNIVERSITY OF ILLINOIS, 1952

URBANA, ILLINOIS

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THE INFLUENCE OF UPPERMOST AXILLARY SHOOTS AND PLANT GROWTH SUBSTANCES ON THE DEVELOPMENT OF THE LOWER AXILLARY SHOOTS OF DENT CORN

The presence of the lower non-functional axillary shoots on the corn plant was observed a number of years ago. The shoots are produced in the axils of each lower leaf of the corn plant during the early stages of development. The pattern of development is from the base upward so that the uppermost axiliary shoot, the one which produces an ear, is the last one to develop just prior to tassel differentiation. Since the axillary shoots develop in acropetal succession, the size of individual shoots decreases from the base upward during the early stages. Later, however, the size sequence reverses; the uppermost shoots become larger than the lower shoots.

Ears develop from the upper one or more axillary shoots, depending upon whether the plants are single or multiple-eared types. However, soil fertility and rate of planting also have some influence on the number of upper axillary shoots which develop into ears. The axillary shoots immediately below those which normally develop into ears, do not produce ears and, in general, do not develop beyond the initial stages. The axillary shoots at the base of the plants do not produce ears but frequently develop into tillers. In so far as could be determined, no research has been reported in the literature which offers any explanation for the failure of development of these lower axillary shoots.

The present work was undertaken to determine some of the factors influencing the development, or lack of development, of the lower axillary shoots of dent corn. Several crosses were included in the investigation: a three-eared single cross, several two-eared single crosses, a single cross pre-

dominantly one-eared, and a commercial hybrid. Studies on the developmental pattern of axillary shoots included observations on the number of shoots which silked, time of silking, and number of ears produced per plant. To determine the effect of time of pollination of upper and lower axillary shoots, comparisons were made between plants pollinated naturally and those which had all shoots pollinated simultaneously.

The influence of upper axillary shoots on the development of lower shoots was studied with respect to the effect of the upper shoots when they were left on the plant in the unpollinated condition, shoots covered, and the effect of removal of the upper axillary shoots.

Six chemicals representing major groups of synthetic growth substances were used in the investigation. Chemicals included were indoleacetic acid and indolebutyric acid of the indole group, naphthaleneacetic acid of the naphthalene derivatives, p-chlorophenoxyacetic acid of the substituted phenoxy group, and gamma-phenylbutyric acid and 2,3,5-triiodobenzoic acid of the group of so-called growth substance antagonists. These compounds were applied in an attempt to alter the normal pattern of development of axillary shoots.

The growth substance content of the axillary shoots was determined by means of a colorimetric method and a bio-assay method (split-pea test). The main objectives were to determine whether there was any difference in growth substance content of the upper and lower shoots, and whether the removal of the upper shoots caused any change in the growth substance content of the lower shoots.

Results And Conclusions

1. Under the natural conditions of the experiment, axillary shoots below those which produce ears silked, but did not develop grain. Simultaneous pollination of upper and lower shoots with viable pollen did not result in any development of lower shoots beyond the silking stage.

2. The inhibitory effect of upper shoots on the development of the lower shoots was demonstrated by the fact that lower axillary shoots did not develop when upper shoots were pollinated or kept unpollinated; however, when the upper shoots were removed prior to silking, the axillary shoots immediately below those removed developed and produced normal ears.

3. The application of synthetic growth substances was ineffective in replacing the inhibitory effect of upper shoots or in stimulating development of lower axillary shoots. However there were some specific effects, development of small deformed ears from the application of indoleacetic acid and 2,3,5-triiodobenzoic acid to shanks of the upper shoots, inhibited development of upper shoots with injections of an aqueous solution of a-naphthaleneacetic acid, and parthenocarpic development of grain from the application of p-chlorophenoxyacetic acid to shank or stalk tissue.

4. On the basis of the colorimetric method, the upper axillary shoots which normally develop into ears had a higher concentration of growth substance than lower shoots. There was a measurable quantity of growth substance in the axillary shoots at silking time. Ten days later the concentration in the upper three shoots of the three-eared single cross was more than doubled in both pollinated and unpollinated plants while there was no change in concentration in the lower shoots. The removal of the upper two shoots prior to silking resulted in a marked increase in the growth substance content of the lower axillary shoots. The growth substance present in pollinated shoots was active in the split-pea test whereas the growth substance in unpollinated shoots was inactive, indicating that the colorimetric method measures an inactive form as well as an active form of growth substance.

VITA

The author was born March 30, 1920, at El Paso, Illinois, in Woodford county. He was graduated from the El Paso Township High School in 1938. He attended the University of Illinois from September, 1940, until June 1942, when he enlisted in the Army. After serving three ond one half years, he re-entered the University of Illinois and in June, 1947, was graduated with honors, receiving the degree of Bachelor of Science with a major in Agronomy. The next semester he entered the Graduate College of the University of Illinois and in October, 1948, received the degree of Master of Science in Agronomy.

Throughout his graduate work he has been employed by the University of Illinois Department of Agronomy and since September, 1950, has been First Assistant in Soil Fertility.

He is a member of Alpha Zeta, Gamma Sigma Delta, Phi Sigma, and Sigma Xi.

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